

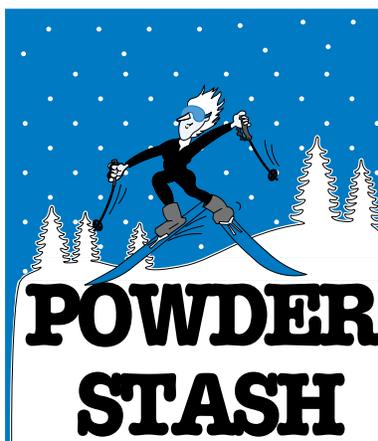
# A Newsletter for Friends of the CAIC

Fall 2000 ❄ Volume 5 Number 1

# THE Beacon

For most people summer is a time for biking, hiking, and BBQ's. In Colorado there are a few strange folk that make skiing last yearlong.

I as well as a few of my more demented friends are members of this latter group. We, however, prefer to think of this dementia as more of a healthy addiction. Exercise, high altitude, clean air, flowers everywhere, wildlife, climbing further and further into the backcountry as the summer progresses to find whatever long, skinny snowfields still exist. Much to the bemusement of our dear and long suffering loved ones, I am sure. For years I have been thinking of palm trees and gold sand beaches as winter drags into spring. Every year, instead of a plane trip with one carry-on duffel bag with nothing but a mask, snorkel, a T-shirt, shorts and swim suit I end up lugging skis, backpacks, ice tools and



the like on some trip to the frozen wastes of the world. I don't know what it is, but ski vacations just keep winning out. On the 4th of July I asked myself, "What am I doing skiing today? Shouldn't I be out sailing or sitting on someone's back deck waiting for the fireworks?" as we hiked up to ski the Baldy chutes near Breckenridge. Unbelievable, now here it is, the middle of September, and I am driving to Saint Mary's Glacier to get another month in. I've lost count, but I think I have teleskied at least once each month for the last 5 or so years. In all that time I have only

missed one month, a September, and that one time I went on a climbing trip to Canada with crampons sans skis.

So here we go, a record warm summer, and I am nervous that there won't be any place to ski in October. I could channel

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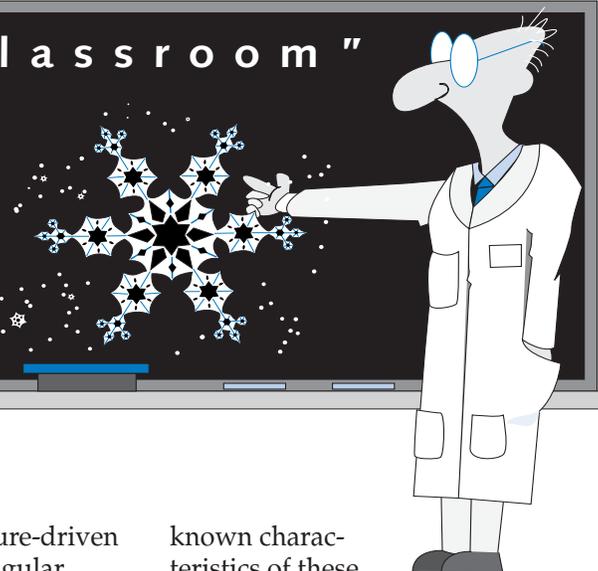


photo: Todd Eastman

Summit of Baldy, July 4th, 2000

" professor flake's classroom "

## Depth Hoar and Avalanche Accidents: The Relationship Exposed.



Adapted from "Snow Temperature Patterns and Artificial Avalanche Release" (paper presented at ISSW'92 in Breckenridge) and edited for *The Beacon*.

By Nick Logan

Why can a person safely traverse most of a slope before it releases in a roaring avalanche? Or how can several people ski a snowfield without incident and the 3rd, 5th or 10th person trigger an avalanche? The answer might lie in localized snow temperature patterns around terrain features.

To most people snow appears the same from all angles—white and cold. But the snowpack really consists of many layers of snow. They are formed from different storm and weather events. Since snow exists close its natural melting point, snow grains change their shape and size from subtle differences in pressure and temperature. The process, called metamorphism, causes snowpack layers to either gain or lose strength over time.

If the snow temperature difference over a short distance (the temperature gradient) is small, less than 1°C in 10cm, the snow grains become rounded and bond together to form a strong snow layer. However, if the temperature difference is more than 1°C in 10cm the grains change into angular shapes that have poor bonds to their neighbors. "Sugar snow" or "squares" are common names for this type of snow. The resulting layers can be thick or thin relative to the total snowpack and can be found at

any depth. If this temperature-driven process continues, large, angular, hollow grains develop. This is called depth hoar and it is no stranger to the Colorado snowpack.

Depth hoar abounds on shady slopes, especially where the snowpack is shallow and around rock outcrops and boulder fields. There may be no depth hoar at all several feet away where the snowpack is much deeper. This sugary snow can easily collapse under fresh, heavy snow or from the weight of a person. When the snow collapses locally and transfers an unmanageable burden of stress into the surrounding snowpack, it too collapses. This reaction can continue across the slope and trigger an avalanche—often in just a few seconds.

So here is the key to the questions above. Since snow depth and temperature vary from one place to another, so do their effects on snow structure. Thus, if the snowpack has a variety of structural properties, sometimes only a few feet apart, the potential to trigger an avalanche also varies from one place to another across the slope.

Have you ever heard that if you have to cross a potential avalanche slope that you should go from one "island of safety" to another? These safe points are usually described as being rock outcrops or other shallow terrain features. Ironically, these are the precise places where sugar snow and depth hoar grow best because of the significant temperature difference between the warmer rocks or ground and the colder snow. Based on the

known characteristics of these "tender spots," a question must be raised about the island-of-safety concept in general. Could it be that these are actually regions of snowpack frailty harboring even greater risk to unwary backcountry travelers? The answer is YES. (But islands of safety are still very important when crossing avalanche slopes when they are large enough to split a running avalanche and provide a relatively safe spot.)

When examining a selection of Colorado avalanche accidents, the trigger zone can be linked to metamorphism around local terrain features. After visiting accident sites, studying photographs, reading accident reports, and interviewing witnesses and survivors, a similarity has been found in several incidents: The victim (trigger) was near rocks or a thin area of the snow cover when the avalanche started. Let's look at five avalanche accidents that can be linked to "tender spots" just under the snow surface.

Case #1. On a sunny Christmas Day, two backcountry skiers were traversing a short slope at timberline. Along their route, one of the skiers decided to make some tracks on a short slope nearby. After two or three turns he fell in the soft snow. As he struggled to get up, the snow avalanched and quickly suffocated him in the shallow debris at the bottom.

A snow profile and other snowpit data revealed no definitive clues as to why the slope avalanched.

However, in the fall line directly above the recovery site was a single large rock (6 feet x 6 feet x 4 feet high) that had been buried beneath the snow. According to the witness, this is where the victim originally fell. There were no other terrain irregularities in the immediate area.

Case #2. In an incident near Wolf Creek Pass, two skiers descended a steep slope one-at-a-time and waited in a safe spot near the bottom for the third person to come down. Looking for softer snow, the victim entered the open bowl from a gentle trough some distance away. An avalanche released as she made a turn at the end of a rock rib. The propagating fracture line ripped across the bowl from her position. Unfortunately, she did not survive the avalanche.

As in Case #1, no significant weak layers were found in the snow. Shovel shear tests produced results only with considerable effort. In the accident report one investigator wrote: "It is my contention, based on the absence of significant weak layers in the upper crown (fracture line), that the third person skied over the area of the rock rib where the snow was not over two or three feet deep (as compared to more than 10 feet deep or more in the rest of the avalanche starting zone); that the snow in that portion of the snowpack was weakened by metamorphism; that her skiing over that portion caused local failure which then resulted in the failure of the larger, more consolidated portion of the starting zone." In this case, two people had already descended the bowl safely before the third person triggered the avalanche.

Case #3. On one sunny Colorado day an experienced and well-equipped party of four was making its way above timberline near Jones Pass. A short but steep, snow-cov-

ered ridge stood between them and their goal. Reflecting on past avalanche training, they choose to send one person at a time to a safe area some 600 feet away while the others watched from a safe location.

As the first skier advanced toward the ridge, he decided to alter his route to avoid the avalanche starting zone near the ridge crest. He elected to skirt the toe of the slope and go around it at the far end. His new route took him through several exposed boulders near the compression zone at the bottom of the steep pitch. Partway across he heard and felt the snow settle around him.

While he used good judgment to avoid the obvious starting zone higher up, he was not aware of the depth hoar he would encounter around the rocks. From the toe of the slope he triggered a sudden collapse which brought down snow from the ridge. Fortunately, he managed to ride on top of the avalanche until it came to rest in the gentle runout zone.

Case #4. Another incident occurred in the San Juan Mountains near the town of Rico. On a March afternoon, two backcountry skiers were enjoying their outing when one triggered an avalanche. The accident site faces WNW and is well below timberline at 9,186 feet in elevation.

The first person skied the slope with no sign of danger. He was waiting near the edge of the trees for his friend to catch up. She began her descent and after several turns, passed near an exposed rock in the small snowfield. As she did this a slide released that engulfed her in the moving snow. This story had a happy ending when she was found alive after several minutes of frantic random probing.

Case #5. This incident is not a true accident because the skier was not involved in the moving snow. However, it is a prime example of the

"tender spot" effect. In February 1984 near Breckenridge, a series of pictures was taken of a skier triggering an avalanche. This is what happened.

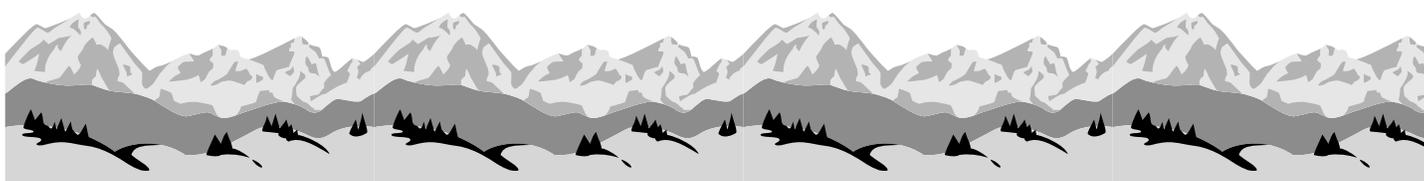
The skier began his descent from an elevation of 12,630 feet on the lee side of an exposed ridge. He made about 20 good turns before passing within 15 feet of a partly-exposed, low rocky knoll. Just as he went by, the avalanche released above him. Frantic shouts from his friends on the ridgetop prompted him to escape to the side and away from the churning snow bearing down on him.

While the bed surface (layer the avalanche slid on) uphill of the rocks was smooth, in and around the rocks it was rough and irregular. Snow in this small section of the snowfield was made up of weak, granular depth hoar, and was the "Achilles heel" of the local area.

The "tender spot" plays a major role in some human-triggered avalanches. It is, however, not the only explanation for avalanche accidents. Other contributory factors must also be present, such as low shear and tensile strength. If both of these are too weak to compensate for local snow-failure at the "tender spot," an avalanche will occur.

We can use this knowledge to our advantage. Good routefinding can help avoid the obvious weak areas where you can see rocks or bushes protruding through the shallow snow. The problem is, you can't see these potential trigger zones if they lurk just beneath the snow.

To learn more about avalanche safety, such as good routefinding techniques to avoid dangerous areas, take a reputable avalanche course. If you plan to travel in some of Colorado's steep backcountry terrain this winter, you should do so with a quiver full of avalanche knowledge. It may just keep you out of an avalanche. ❄️



# Babes in the Backcountry:

by Leslie Ross

Regardless of your gender, many of us can consider ourselves “Babes” in the backcountry in relation to snow science. It takes years of exploration and evaluation of snow to be able to consider oneself an expert. Backcountry skiers have been known to head out blindly with their “perceived” more experienced friends in search of radical skiing. This desire for steep and deep turns may often overshadow one’s rational voice or instincts about a potentially dangerous situation. A lack of thorough knowledge of avalanche terrain has often led backcountry skiers into situations that may have been prevented with an increased awareness of snow and avalanches. In an attempt to educate more women on safe travel techniques in avalanche prone terrain and to also create a balance in the outdoor community by getting more women involved in backcountry skiing, Babes in the Backcountry had its birth.

In its fifth year, “Babes in the Backcountry” Clinics continue to help build confidence and empower women backcountry enthusiasts. Designed for women and taught by women (we do have a male instructor), the Babes’ mission is to provide education to women in a non-threatening, hands-on, outdoor environment, where questions are always welcomed and encouraged. The goal is to make the whole snow experience less intimidating. The instructors stress using common sense and proper planning to help make smart decisions when traveling in avalanche-prone terrain. Topics range from avalanche characteristics, snow pit analysis and stabili-

ty tests, effective beacon search patterns, rescue protocol, route selection, safe travel techniques, weather forecasting, basic map skills, appropriate backcountry equipment, clothing and nutrition needs. Through education and knowledge of snow, weather, slope angles and the human factor, participants gain an increased understanding of the factors involved in avalanche accidents as well as the tools and skills necessary to react appropriately if an avalanche were to occur. The workshops provide a forum for women to strengthen and enhance their decision-making skills and create an opportunity for women to become less reliant on others and more responsible for themselves.



Instructor Sandy Kobrock doing a shovel tap test.

The outstanding Babes’ staff is comprised of a group of some of the most highly trained women and men in their field. Betsy Armstrong, co-author of *The Avalanche Book* and founding member of American Association of Avalanche Professionals (AAAP), has done extensive snow and avalanche research throughout the West. Owner and operator of Wolf Creek Backcountry Yurts and a professional member of the AAAP, Sandy Kobrock comes to the Babes with years of experience as a ski patroller, avalanche dog handler and instructor for the Silverton Avalanche School. Certified avalanche rescue dog handler Holly English brings her knowledge of backcountry

safety to the workshop developed from years working as a Backcountry Ranger for the US Forest Service and as professional ski patroller and National Outdoor Leadership School instructor. And lastly, Scott Toepfer, a forecaster with CAIC, and also a professional member of the AAAP, (the “token male”) shares his invaluable knowledge of the Colorado snow pack and avalanche rescue skills cultivated from years in the field of snow science working as a ski patroller, snow safety director and avalanche forecaster.

The majority of the workshops are held at Francie’s cabin, located in the Summit Huts Association system outside of Breckenridge. The cabin, a comfortable and cozy space, adds another unique aspect to the Babe’s Clinics. Francie’s Cabin is furnished with a wood burning stove for heat, propane cook-tops, indoor composting toilets, wood-burning sauna and bunk style beds with pillows. The high alpine environment surrounding the

cabin provides an incredibly aesthetic setting for the workshops with appropriate terrain to learn and practice avalanche rescue techniques.

The outdoor industry supports the program by providing avalanche rescue gear and backcountry equipment for participants to demo during the workshop including avalanche transceivers, shovels, probe poles, daypacks and outdoor clothing. Equipment from Ortovox, Life Link, Backcountry Access, Black Diamond, Mountainsmith and Patagonia provides students with an opportunity to become more knowledgeable and familiar with the tools essential for safe backcountry travel.

Six years ago, founding director

photo: Leslie Ross

# Women's Backcountry Education



photo: Leslie Ross

Babes testing the snowpack with the Banzai Jump Test.

Leslie Ross presented the Babe's idea to Summit Huts Association, as the concept was congruent with SHA's mission to educate backcountry users. As both an Event Coordinator and Hut Master for SHA, Leslie wanted to share her love of the outdoors and her expertise in telemark skiing and mountaineering with other women. The first two-day clinic has now developed into several clinics, for both beginner and intermediate level backcountry users. Telemark, alpine and snowboard women, ages 18 and older are welcome, but good general physical fitness is highly recommended. For the introductory class, sturdy backcountry skis with metal edges and skins, split boards, or snowshoes are required to access the hut. Women participating in the advanced class must use either sturdy backcountry skis with metal edges or split-boards. Workshop prices include overnight hut fees, professional instruction, evening slide shows and lectures,

demo gear, healthy dinners, breakfasts, snacks (vegetarian meals), a chance to meet other backcountry "Babes" with similar interests and an overall fun weekend getaway at a backcountry cabin.

For more information on the Babes in the Backcountry Workshops, contact Leslie Ross at [lross@colorado.net](mailto:lross@colorado.net), (970) 453-1846 or at [www.backcountry-babes.com](http://www.backcountry-babes.com). More information on Summit Huts Association can be accessed through [www.huts.org](http://www.huts.org). The 10th Mountain Division Hut Association at (970) 925-5775 takes general hut reservations. ❄️

## Clinic Dates:

- Backcountry Safety Clinic (coed) — Dec. 16-17, 2000
- Babes Backcountry Skills Workshop— February 17-19, 2001 (Francie's Cabin)
- Babes Refresher Clinic— March 2-3, 2001 (Janet's Cabin)

## Powder Stash

continued from page one

my energy into a Mexican beach vacation, but no, I'm more concerned with what those two little monsters, El Nino and La Nina are doing. I really do have an incredible offer to head to Mexico this coming November, I will not have to blow it off so I can attend a snow science conference in Montana. A long time ski patrol friend and his wife have extended numerous offers of a self sufficient sail boat cruise to the Caribbean for the last 5 years, and have extended it again for this coming spring of 2001. But, oh boy, it looks like I have signed on for a climbing trip into the Alaska Range for next spring.

Do I just choose to ignore this inner voice that is screaming: Beaches, Palm Trees, Swimsuits? Do I just forget these long standing invitations to the Gulf of Mexico with exotic bathing beauties and palm covered islands whenever someone mentions glaciers or snow? Or could it go deeper than that? Certainly genetics are playing a role in this. My grandfather made skis and bindings for my brothers and me before I was even 5 years old. All my aunts, uncles, cousins, and brothers ski, but most on a very limited basis if at all anymore. (Are my genes more mutant than theirs, I wonder.) I am just so confused. If any others of you are faced with this same issue, I would like to hear your thoughts, hopefully before my next spring ski trip to the San Juans or my aforementioned trip to Alaska. Otherwise Amy will be

heading to the warm confines of Mexico this fall without me. I wonder if the State of Colorado has a substance abuse program for problems such as mine?

Well, enough of that. In our last issue the Editors Corner was renamed Scott's Powder Stash. I will be simplifying that to the plain old Powder Stash. I wouldn't want it to be said that I am always letting out secret stashes, so I will leave those stashes anonymous for now. We'll just let it slip about the Baldy Chutes this time.

In this issue we have our own Professor Flake, Nick Logan, with a look at that insidious evil Doctor Depth Hoar. And with an almost certain prognosis for depth hoar in the forecast, this timely article will look at growth patterns of this nemesis around boulders, stumps and the like. Nick has done some research on this topic right here in Colorado. This article may provide some of you with another arrow in your quiver for your arsenal in the annual war against avalanches.

Summit Huts Association has put together some excellent avalanche classes for the last couple of years. Nothing new about that, but what is somewhat unique is that these classes are for women only and are held at backcountry huts around Summit County. Leslie Ross has contributed an article on this most excellent series of courses. Also see our list of other upcoming classes in Colorado. We update this list periodically on our web site as well, [www.caic.state.co.us](http://www.caic.state.co.us).

So once again as we are head into another spectacular Colorado winter, we hope yours will be safe and deep. ❄️

# COLORADO AVALANCHE CLASSES

## 2000-2001

Month	Location/Host	Class Type	Phone
<b>November</b>			
16	Lakewood/REI	Awareness	800-754-2378
21	Vail Public Library/CAIC	Awareness	970-479-2191
30	Colorado Springs/Mountain Chalet	Awareness	719-633-0732
<b>December</b>			
5	Ft Collins/Mountain Shop	Awareness	970-493-5720
6	Denver/BPPI	Awareness	303-569-0100
8-10	Crested Butte/ATTE	Level I	800-349-5219
14-17	Denver/Berthoud Pass/AAI	Level I	303-761-7070
15-17	Golden/Berthoud Pass/ATTE	Level I	800-349-5219
16-17	Francies Cabin/Summit Huts	Beacon Class	970-453-8583
19-20	Breckenridge Beacon Clinic	Beacon Clinic	970-453-2201
<b>January</b>			
4	Englewood/BPPI	Awareness	303-858-1726
5-7	Crested Butte/ATTE	Level I	800-349-5219
5-7	Telluride/Ski Patrol	Level I	970-728-3829
5-7	Aspen/Aspen Expeditions	Level I	970-925-7625
7	Leadville/HMI	Awareness	719-486-8200
8	Loveland/Loveland Mountain Club	Awareness	970-223-5274
11 & 14	Golden/Bent Gate	BC Short Course	303-271-9382
12-17	Golden/Berthoud Pass/ATTE	Level I	800-349-5219
12-13	Steamboat Springs/Ski Haus	BC Short Course	800-932-3019
15-17	Leadville/HMI	Level I	719-486-8200
12-14	Denver/BPPI	Level I	800-754-2378
12-14	Summit County/Aspen Expeditions	Level I	970-925-7625
13-14	Vail/Gore Range Mountain Works	BC Short Course	970-476-7625
17,18,20	Durango/Hesperus Ski Patrol	Basic NSP	970-247-4617
17-21	Leadville/HMI	Level II	719-486-8200
18-21	Englewood/Berthoud Pass/AAI	Level I	303-761-7070
19-21	Golden/Berthoud Pass/ATTE	Level II	800-349-5219
19 & 20	Aspen/Aspen S&R	BC Short Course	970-925-6618
19-21	Silverton/Silverton Avalanche School	Level I	970-387-5531
19-21	Aspen/Aspen Expeditions	Level II	970-925-7625
22-23	Berthoud Pass/AAI	Level II	719-395-2951
24 & 27	Ft Collins/Mountain Shop	BC Short Course	970-493-5720
26-28	Crested Butte/ATTE	Level II	800-349-5219
26-28	Silverton/Silverton Avalanche School	Level I	970-387-5531
29-31	Crested Butte/ATTE	Level III	800-349-5219
31	Denver/BPPI	Awareness	800-754-2378
<b>February</b>			
2-4	Silverton/Silverton Avalanche School	Level II	970-387-5531
7,8 & 10	Durango/Hesperus Ski Patrol	NSP Basic	970-247-4617

8-11	Estin Hut/Aspen Alpine Guides	Level I	970-925-6618
8-11	Denver/BPPG	Level II	800-754-2378
9-11	Crested Butte/ATTE	Level I	800-349-5219
11-13	Aspen/Aspen Expeditions	Level III	970-925-7625
15-18	Aspen/Aspen Expeditions	Level III	970-925-7625
15-18	Englewood/Berthoud Pass/AAI	Level I	303-761-7070
16-18	Golden/Berthoud Pass/ATTE	Level I	800-349-5219
16-17	Summit County/Aspen Expeditions	Level I	970-925-7625
17-19	<i>Babes in B.C./Francies Cabin/Summit Huts</i>	Level I	970-453-8583
23-25	Golden/Berthoud Pass/ATTE	Level I	800-349-5219
23-25	Aspen/Aspen Expeditions	Level I	970-925-7625

**March**

1-4	Estin Hut/Aspen Alpine Guides	Level II	970-925-6618
2-3	Janet's Cabin/Babes Refresher	Refresher	970-453-1846
2-4	Crested Butte/ATTE	Level I	800-349-5219
9-11	Golden/Berthoud Pass/ATTE	Level I	800-349-5219
9-11	Silverton/AAI	Level I	719-395-2951
9-11	Summit County/Aspen Expeditions	Level II	970-925-7625
17-19	Silverton/AAI	Level III	307-733-3315

- \* AAI is the American Avalanche Institute
- \* ATTE is Adventures To The Edge
- \* HMI is the High Mountain Institute
- \* NSP is the National Ski Patrol
- \* BPPI is Berthoud Pass Powder Guides

For the latest updates on avalanche classes, see our web site: [www.caic.state.co.us](http://www.caic.state.co.us)

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## Renewal Notice (or recruit a Friend)

**Yes, I will join the Friends of the Avalanche Center. Enclosed is my donation of:**

- \$30\*, which gives me a CAIC window decal (if I am a new Friend), The Beacon newsletter, the Avalanche Wise booklet, and your morning forecast by e-mail.
- \$45\*, which gives me all the stuff above, plus an afternoon forecast sent by e-mail.
- Please accept my additional donation of \$\_\_\_\_\_\*
- I'm a renewing member.
- I'm a new member. Please send a CAIC decal.

\* Your donation is tax deductible and your canceled check is your receipt.

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**Please mail this form & your check payable to "CAIC" to: Colorado Avalanche Information Center  
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**MISSION:** The Colorado Avalanche Information Center promotes safety by reducing the impact of avalanches on recreation, industry, and transportation in the state through a program of forecasting and education.

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Jerry Roberts—Forecaster, Silverton  
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Halsted Morris—Avalanche Educator  
Denny Hogan—Avalanche Educator

Durango .....970-247-8187  
Summit County .....970-668-0600  
Denver .....303-275-5360  
Fort Collins .....970-482-0457  
Colorado Springs .....719-520-0020  
USFS-Aspen .....970-920-1664  
USFS-Minturn .....970-827-5687

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